

SEEING AND BELIEVING.

BY HAROLD WILSON, M. D.



frequently deceived us, we are often not satisfied with the evidence they give us until we have verified it by touch or smell or hearing or taste, or by looking at some doubtful thing from different points of view, or under a different lighting.

We are not willing to believe that a conjurer actually draws rabbits from a man's ear or coins from the tip of his nose just because our eyes tell us such tales. Sometimes our deceptions are so lasting that things must be made wrong in order to look right, which seems rather contradictory. If we look at the letter S or the figure 8 as carefully as we can, the upper and lower halves seem to be almost exactly the same size. If we turn them upside down, thus, 8, S, the difference in the size of the loops is quite astonishing, and we wonder how we could have been so mistaken; yet perhaps the truth is that the loops are neither so different nor so much alike as they seem to be, as we see when we look at them turned upon their sides, thus, S, 8, ∞.

+

The eye is such a delicate bit of machinery, it has so many parts, and so many different kinds of work to do, and such long hours of labor, that it is not surprising, after all, if in the capacity of receiving-office for so many millions of light-waves every minute, it should

It is an old and a wise saying that "seeing is believing," yet everybody knows that very often what we see, and therefore believe, proves to be not really true at all. As we grow older, finding that our eyes have so

occasionally send wrong messages to the central station in the brain. Nor is it to be wondered at if the mind itself, having so many other things to attend to at the same time, sometimes fails to understand what certain messages from the eye may mean. These mistakes on the part of the mind in interpreting the communications which the eye sends to it, are called *illusions of sight*.

Moreover, in the eye itself certain things may go on which give us wrong sensations, which, although not truly illusions, are very much like them. Thus, when we suddenly strike our heads or faces against something in the dark, we see "stars," or bright sparks, which we know are not real lights, though they are quite as bright and sparkling as if they were. When we close one eye and look straight ahead at some word or letter in the middle of this page, for example, we seem to see not only the thing we are looking at, but everything else immediately about it and for a long way on each side. But the truth is, there is a large round spot, somewhere near the point at which we are looking, in which we see nothing. Curiously enough, the existence of this blind spot was not discovered by accident, and nobody ever suspected it until Mariotte reasoned from the construction of the

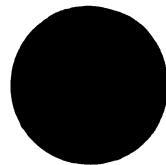


FIG. 1. THE VANISHING DISK.

eyeball that it must exist, and proceeded to find it. Now we can all find it very easily. If you will hold Fig. 1 straight in front of the right eye, and about ten and a half inches away from it, the left eye being kept closed, then look sharply at the center of the little cross, every-

thing being properly adjusted, the round black spot will disappear completely from view.

Some of our most delightful sensations are those of color. Nature has given us a great profusion of them, but the eye is not satisfied with what it gets legitimately, as it were, but creates for itself a lot of imaginary colors, which are often very hard to distinguish from the real ones which the light makes. If we take a sheet of gray or white paper and place upon it a small piece of orange-red paper, look intently at the

red paper for a few seconds and then suddenly take it away, we will see a patch of a light-green color, which moves about as we move our eyes, and soon fades away.

A bit of yellow paper gives us a blue patch, green a violet red, and with a package of kindergarten color-papers to experiment with, the reader will find that each one has its own unchanging and especial successor when tried in the same fashion. These after-colors are the creations of our eyes, and are not really where they seem to be. They are quite as unreal as are other sorts of ghosts. With a candle or lamp, a few pieces of colored glass, and a lead pencil, we can display some other curious

fancies of the eyes by making what are called colored shadows. Fig. 2 shows how it is done. Using red glass, the shadow of the pencil upon the wall (a piece of white paper is better) looks blue-green; with blue glass, yellow; with green glass, rose; and so on. It is hard to convince ourselves that the shadow is not actually of the color it seems to be, and if I did not tell you that it was an illusion, you might never discover the fact.

When we come to study the shapes and sizes of things, we find that the eyes are often

greatly deceived. We all know how large the full moon looks when it has just risen, and how much smaller it appears when it rides higher in the sky; and those of you who have ever

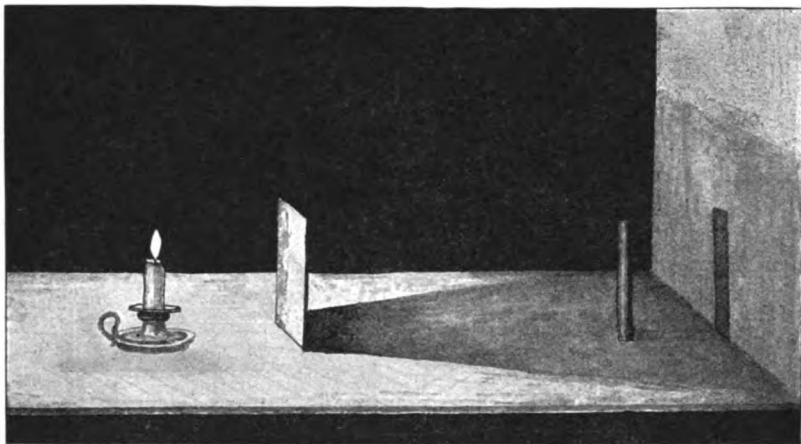


FIG. 2. THE COLORED SHADOWS.

looked at it through a telescope or a pair of opera-glasses know that although it is then magnified, it actually looks smaller than with the naked eye. Those who know tell us that the big moon we see at the horizon is an illusion, and that while it actually is magnified by refraction, it looks much larger because we see it a long way off, through the trees, or over houses, or down the street, and comparing it with those objects of which we know the size, fancy it must be very large because it is so far away; and that when up in the sky, or when seen through an opera-glass, it seems nearer, and therefore looks smaller.

In Fig. 3, the row of dots between *a* and *b* makes that distance seem greater than the distance between *b* and *c*, although upon measurement you will find it to be just equal. Fig. 4 does not look exactly square: the horizontal lines make it seem too tall. The artist was instructed to make the horizontal lines in Figs. 5 and 6 parallel to each other, and no doubt he has done so, although those in Fig. 5 seem very far from it, and it is perfectly plain to the eye that the upper ones in Fig. 6 separate more at the middle



FIG. 3.

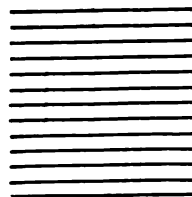


FIG. 4.

and that the lower ones come closer together there than at the ends; and if the top of the page is tipped away from you so that you look obliquely down at it, these appearances are all the more striking. Yet if we turn the page about and look at the drawings from the side, we see at once that the artist has done his work truly, and that it is our eyes that have been at fault. So, in Fig. 7, the circle seems to dip in or flatten at the corners of the square, yet it is positively a true and uniform curve. In Fig. 8 the line running upward on the right-hand side of the black rectangle is the direct continuation of one of the two lower lines on the left. Everybody says that it

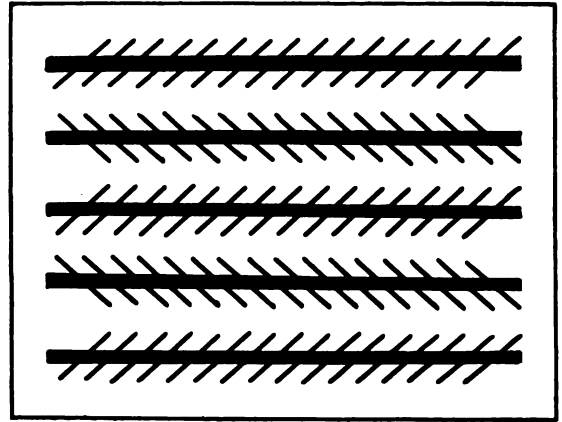


FIG. 5.

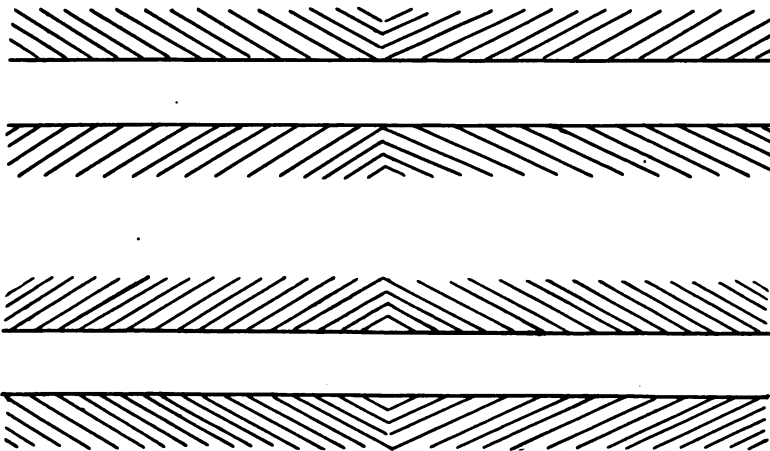


FIG. 6.

is with the upper one of these lines; and as we examine it carefully, running the eye back and forth so as to be sure, this certainly seems to be true. But hold the figure so as to look along the line as a carpenter looks along the edge of a board, and it is surprising to see how much we have been mistaken.

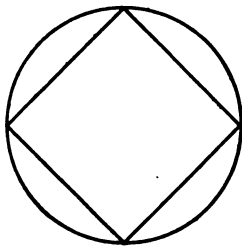


FIG. 7.

cube of which three faces were visible,—the one toward you, the upper, and the left-hand

If I were to ask what Fig. 11 represented, most persons would say that it was a picture of a transparent

one,—as is shown in Fig. 10. Some other person looking on might say, however, that it was a cube showing the *lower* and the *right-hand* faces, as shown in Fig. 9; and upon looking at it again, sure enough, this seems to be so; and yet, while we still look at it, it suddenly changes, and once more looks like Fig. 10. With a little

practice, we discover that we can make it look either way at pleasure, though it has an uncomfortable fashion of turning about of its own accord. Generally we can see it like Fig. 10 more easily, perhaps because that

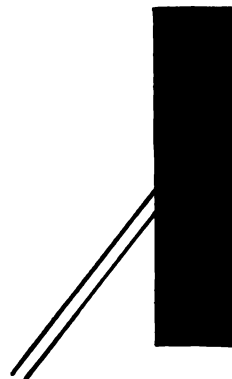


FIG. 8.

is the way most real cubes appear as we look at them usually from above. So Fig. 12 we can see either as a flight of steps leading up to the left, or as an overhanging or upside-down

stairway which we could climb only by standing upon our heads. It is a little hard to see these two stairways, and you may succeed better by turning the page around while looking at the drawing. It is easy, sometimes, to see objects that do not exist: thus, in Fig. 13, if the page is tipped a little and held so that the right eye looks along the line *a b*, and the

left along the line *c d*, both eyes being open and looking at the point where the two lines cross, a third line is seen standing right up from the paper like a little rod or pin. Fig. 14, when looked at with one eye from a point where it can look along all of the lines without moving the head,—that is, at a point where all the lines would meet if they were drawn long enough,—shows a lot of black pins standing upright as if stuck into the page.

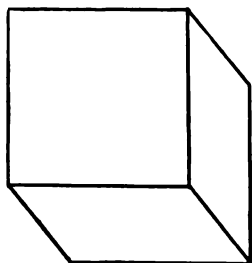


FIG. 9.

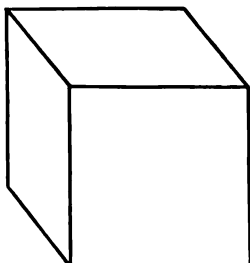


FIG. 10.

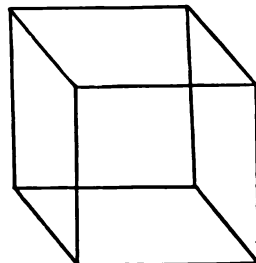


FIG. 11.

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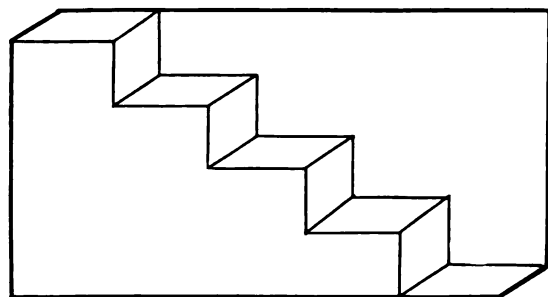


FIG. 12.

left along the line *c d*, both eyes being open and looking at the point where the two lines cross, a third line is seen standing right up from the paper like a little rod or pin. Fig. 14, when looked at with one eye from a point where it can look along all of the lines without moving the head,—that is, at a point where all the lines would meet if they were drawn long enough,—shows a lot of black pins standing upright as if stuck into the page.

In the picture at the end of this article, it will be found interesting to let the spectators guess which of the stones in the Magic Bridge is longest, and also to estimate the precise dif-

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ference in length between the upper and lower pair. After the guesses have been made, measure them; it will be instructive. Now, we all want to know, of course, how these curious illusions come about, and whether there are others than those we have just seen. Yes, there are many others, and men have known them from very early times. In *ST. NICHOLAS* for October, 1885, Mr. Arlo Bates told how the Greek architects took advantage of these illusions to improve the appearance of the temples; and it has lately been found that the cathedral builders of the Middle Ages also so arranged their lines and curves as to deceive the eye. On the next page, Figs. 15 and 16, copied from the article by Mr. Bates, show how two lines of the same length may be by branching lines made to look quite unequal; but it is a great deal easier to see that they are



FIG. 13.

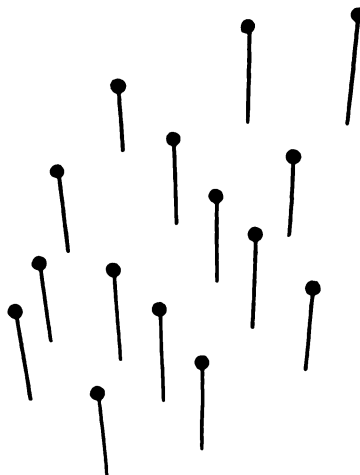


FIG. 14.

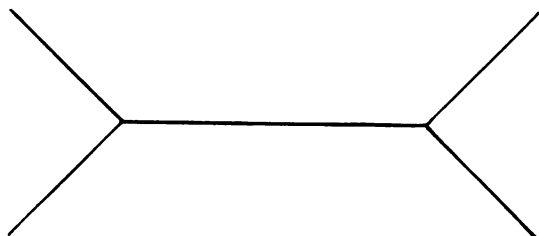


FIG. 15.

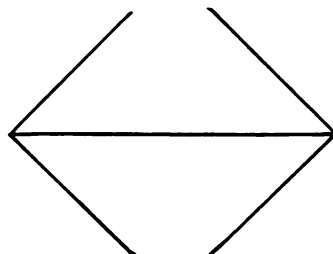
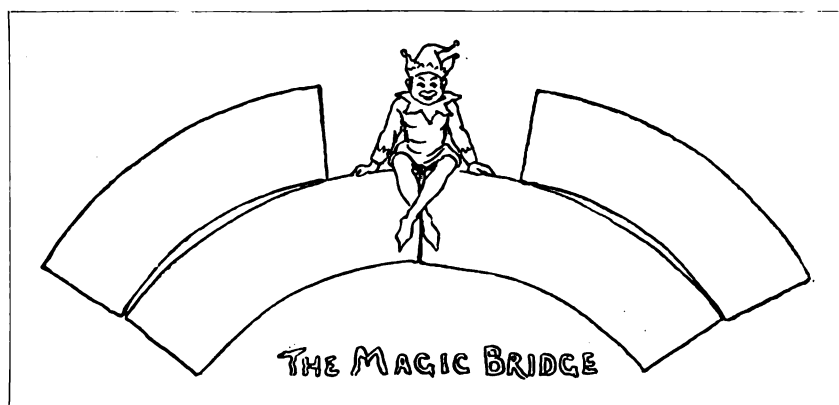


FIG. 16.

illusions than to explain why we are deceived in them. Even the wise men who have studied them do not always agree in their explanations. And then, to understand these explanations, we have to know a great many things that are not so interesting. Besides, what we need most of all to know about them is the fact that they

exist, and that often "things are not what they seem," and that seeing ought not always to be believing. Our eyes must be trained to beware of tricks that may be played upon them, and where our eyes deceive, our brains must help us to find out the truth, even in the midst of apparent error.



THE NEW UMBRELLA.

BY AGNES LEE.

OH, Ella!
With her first umbrella!
She walked abroad like any queen.
She held it proudly for display,
Admired its handle, stroked its sheen,
And never little girl more gay.

Dear Ella!
Such a wee umbrella!
One day upon the market-place
I met her; dripping were her curls.
She looked, despite her sunny face,
The most forlorn of little girls.

"Why, Ella!
Where 's your new umbrella?"
Said I; "the storm has drenched your
hair!
Just see your frock! just see your hat!
And what is this you hug with care? —
A broom, a fiddle, or a cat?"

Oh, Ella!
With her first umbrella!
She looked at me and shyly spoke,
The rain-drops pelted on her yet:
"I have it here beneath my cloak,
Because, you see, it might get wet!"